Credentialing learning in the European OER Ecosystem

ENCORE+ deliverable 5.4

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Executive summary

This report, based on expert interviews, has been produced by the Encore+ project to examine credentialing methodologies in the European OER ecosystem. It is intended to provide impetus to discussion, and so to move forward both debate on the topic and practice in the field.

The report is framed by three educational discourses that converge in the domain of OER:

1) Interoperable representation of learning achievement, including the use of badges.
2) Increasing focus on microcredentials, especially in the context of workplace learning
3) Competence-based human resources management

In summary, our findings are as follows.

We have found no examples of credentialing being implemented in repositories, and some arguments that repositories are no longer useful. Rather, the challenge for the credentialing of learning from OERs lies in identifying an academically effective, affordable and sustainable assessment method. The key questions are "Who carries out the assessment, and how?", with a strong argument for conducting the design and delivery of assessment in different departments or institutions from that of OERs.

We found a strong consensus that competences and learning outcomes have an important role in linking OERs and credentials, but their use remains patchy. The necessary infrastructure of competence frameworks, digital certificates and interoperability specifications is now available to support the issuing of micro-credentials, their stacking into more substantial qualifications or curriculum vitae profiles, and communication of achievement to employers. However, authoring requires substantial time and expertise, and rubrics are needed for assessment. In addition to facilitating assessment, competence structures offer a way to structure learning paths and to create 'stackable' credentials.

Trust in credentials based on learning from OERs is generated by the verifiability of assessment and the issuing institution, and interoperable specifications and competence frameworks are seen as the best way to achieve this. The infrastructure to achieve this is largely in place, with a strong contribution from the European commission and W3C, and technology is not a barrier. The task now is to apply these in practice at scale, and a particular challenge is to achieve practical interoperability of descriptions of credentials across multiple domains and countries.

There is substantial interest in competence-based HR systems which could process credentials generated within the OER ecosystem, but the degree to which this will be an effective recruitment policy is an open question. Collaboration with professional communities is a promising approach, to ensure the relevance of credentials to employment.

There is a lack of business models which provide revenue streams to pay for assessment of learning achieved with OERs. A particular challenge is that the marginal cost for the provision of content is zero, but for provision of assessment it is non-zero, and this provides a strong argument for organisational and financial separation of design and delivery of OERs from that of assessment. Providers should also consider if it is beneficial to outsource and/or distribute OER and MOOC / micro-credential hosting. Potential revenue streams for credentialing learning from OER are:

- Learners' payment to access learning paths (low cost) and assessment (from low to high cost)
- Education institutions and foundations, as a loss leader or to fulfill an educational mission
- The state or the European Commission
- Professional bodies or companies

All are potentially viable, but successful strategies will depend on, and need to engage with, local and global economic and political developments.

1. Introduction

Open Educational Resources (OER) offer benefits to institutions (enabling them to cut their costs by using OERs instead of purchasing materials from publishers and providing a way of raising their public profile), to teachers (who have access to teaching materials, and can form communities of practice that support the sharing of learning materials and pedagogic methods), and to the public (who can access knowledge about topics which interest them without the need to register on a course at an institution). This report considers these contributions of OER to the education sector to be self-evidently valuable, while recognising that in many educational contexts these benefits have only been partially realised, if at all. However, we note that these benefits have largely been situated within the pre-existing structures and practices of the education system. The Encyclopædia Britannica defines a university as an "institution of higher education … having the authority to confer degrees in various fields of study" (Britanica, 2022). In the past, students had a motive to study at a university in order to have access to libraries and to communities of academics which could not be obtained elsewhere. In the present day, access to resources through the internet means that the first of these reasons no longer pertains, and the second has been substantially undermined by technologically mediated social networks. The "authority to confer degrees", however, remains unchallenged as the sole competence of the university, and consequently, it may be argued, the principal means whereby students are attracted and income generated. It is, therefore, understandable that a linkage between OER (which is, by definition, largely out of the control of education institutions) and credentialing processes (which are not only within the control of the institution, but also their key source of prestige and income) raises many concerns for education institutions. It is also understandable that some authors were keen to explicitly rule out such a link, for example Rejas-Muslera et al. (2005).

> Despite the wealth of materials, OER is not a degree-awarding strategy—no one has suggested that OER take the place of institutionally supported open and distance learning. It was thought of more as a means of sharing unique and interesting resources potentially of value to others who would not otherwise have access to them.

This certainty was undermined by the emergence of MOOCs in 2008 (Siemens, 2013), which precisely did trespass on the territory of institutionally supported open and distance learning. The emergence of MOOCs launched a period of intensive activity in higher education that was described by Siemens as reflecting "the angst of educators and administrators in attempting to understand the role of the university in the Internet era" (Siemens, 2013). This angst has echoed through the past decade, and has given rise to a wide range of initiatives which, in one way or another, address the still unresolved relationship between credentials and OER.

To achieve insight into this fast evolving field, we have conducted in-depth interviews with ten experts who have long experience of the topic and direct knowledge of emerging practice. We inform our discussion of the results by contrasting them with the literature, and identifying practical routes forward, barriers and enablers. In seeking insight into this area, the report

focuses on the sectors of higher education and life-long learning, where there is greater potential for innovative practice with credentials than is the case in schools. This is because states exercise a high degree of central control over the award of school certificates maintained, but delegate control over the award of higher education degrees to accredited institutions, as well as tolerating the existence of professional bodies and other organisations which make their own awards independently of state accreditation.

Our hope is that in exploring the issues raised by the linkage between OER and credentials, we will not only provide insight into current practice which makes this connection, but will also make a contribution towards understanding the constraints experienced in the adoption of OER, and indicating a route forward whereby some of the ambitions for the transformational potential of OER can be realised.

2. The context

The evolution of the relationship between credentialing and OER has not been carried out in isolation from other educational trends, but rather is situated at the intersection of a number of educational discourses which converge in the domain of OER, three of which we distinguish here:

1) **Interoperable representation of learning achievement, including the use of badges.**
2) **Increasing focus on microcredentials, especially in the context of workplace learning**
3) **Competence-based human resources management**

All three discourses, and their associated practices, exist independently of each other, and each has a distinct area of application. Moreover, each area has its own internal dynamics, with contrasting views, practices and strands of work and at the point where they intersect we find a highly complex and rapidly evolving landscape. In this section we provide a necessarily brief summary of the key literature and practice in the three other contributing discourses, and identify examples of their interaction.

a) Alternative credentials. Over the past decade there has been widespread concern that employers are experiencing a 'skills-gap', as citizens' knowledge and skills become outdated in a rapidly evolving economy (see, for example, Cornelius (2011), or for a critique of the assumptions underlying this concern, Cappelli (2012). In 2011, Mozilla announced the Open Badge Infrastructure project to support emerging practice in offering digital badges to document learning (Surman, 2011), an initiative that has now evolved into the Badgr platform, owned by Instructure. Brown et al. provide a valuable historical summary of the various terms related to alternative credentials. They point out that "the traditional academy often views the term 'badge' with suspicion as they perceive them as eroding the status, credibility and reputation of conventional

qualifications" (Brown et al. 2021), and this may be a factor in the divergent terminology. In this report we treat 'credentials' and 'qualifications' being synonymous.

According to the European Commission (2016) "40% of European employers have difficulty finding people with the skills they need to grow and innovate", and has identified micro-credentials as a potential solution to the problem. The European Commission Council Proposal for a Council Recommendation COM/2021/770 (European Commission, 2021) defines micro-credentials as "Learning opportunities of smaller volume than for traditional qualifications" which "enable the targeted, flexible acquisition and recognition of knowledge, skills and competences to meet new and emerging needs". They add that "Importantly, micro-credentials do not replace traditional qualifications. Instead, they can complement traditional qualifications and serve as a lifelong learning opportunity to all." Reviewing recent global developments in micro-credentials McGreal and Olcott (2021) provide a similar definition of a micro-credential, but add that micro-credentials "may or may not be stacked towards larger units of accreditation", suggesting that, *pace* the European Commission, there is indeed a potential for micro-credentials to replace traditional qualifications.

The European Commission (2021) also proposes that Member States should

- apply a common EU definition, standards and key principles for the design, issuance and portability of micro-credentials;
- develop the ecosystem for micro-credentials;
- deliver on the potential of micro-credentials to support lifelong learning and employability. (European Commission, 2021)

b) Interoperable representations of learning achievement. The European economy is increasingly integrated, with people being educated in one country and employed in another, creating difficulties in understanding what credentials mean and in comparing them across borders. The European Commission addressed this problem in the Bologna Declaration of 1999 (European Ministers of Education, 1999), which called for the adoption of a system of easily readable and comparable degrees, together with a system of credits. This led to the further development of the European Credit Transfer Accumulation System (ECTS), which had been in place since 1989 (European Commission 2015), and to the establishment of the European Qualifications Framework in 2008, which was revised in 2017. The Europass service and tools have been established by the European Commission to support the implementation of the EQF. Europass describes the ECTS as

> an 8-level, learning outcomes-based framework for all types of qualifications that serves as a translation tool between different national qualifications frameworks. This framework helps improve transparency, comparability and portability of people's qualifications and makes it possible to compare qualifications from different countries and institutions. … which are increasingly accessible through qualification databases. (Europass, N.D)

The same situation pertains in the USA, indeed perhaps to a greater degree because the integration of the economy across states is more complete, and work has been underway on the problem for less time than in Europe. Everhart et al. (2021) conclude that in the USA

> Unfortunately, we currently have too little transparency about credentials and their value. However, this landscape is rapidly changing as state and federal agencies as well as educational institutions, employers, and individual stakeholders are realizing the possibilities of linked open credential data...

As a solution to this problem, the authors identify the Credential Transparency Description Language (CTDL) (Kitchens, Sutton and Barker, 2022), developed by the Credential Engine non-profit organisation.

c) Competence-based human resources management. Employers have long seen the documentation of competences as a route to potentially more effective recruitment practice (e.g. Lado and Wilson, 1994). For over a decade, the European Commission has been developing the European Skills, Competences, Qualifications and Occupations (ESCO) classification (European Commission, 2022), with regular updates, for example in 2019, and the integration of the DigiComp digital competencies in 2022. The MicroHE project proposed a metadata standard for digital credentials and micro-credentials in 2018, which was based on the ESCO metadata schema and added extensions for Higher Education and micro-credentials (MicroHE, 2018). Increasing volumes of data about educational achievement, and about the needs of the market, are making it feasible to consider automating the comparison of the requirements of a job role with data about the competences of potential employees and so expedite recruitment (e.g. Boiko et al. 2021).

Competence-based recruitment has attracted a great deal of attention in the USA. The American Workforce Policy Advisory Board Digital Infrastructure Working Group (2020) argued for the development of an online and interoperable Learning and Employment Record (LER). The LER could be used to "explore the use of competency-based assessments as a means of selecting job applicants rather than relying primarily on formal degrees or years of experience" (Bennett and Lamback, 2020). The U.S. Chamber of Commerce Foundation has taken a leading role in improving labour market information (US Chamber of Commerce Foundation, 2021) to facilitate this development.

Even this brief discussion of the context for credentialing in the OER ecosystem indicates a complex landscape which raises many open questions. Overarching this complexity, however, is the point made a decade ago by Mackintosh, McGreal and Taylor:

> Individuals are free to learn from OER and other digital learning materials hosted on the Internet. The core problem is that learners who access these digital learning materials on the web and acquire knowledge and skills either formally or informally, alone or in groups, cannot readily have their learning assessed and subsequently receive appropriate academic recognition for their efforts. (Mackintosh et al., 2011)

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It is as yet unclear if the initiatives that we have described above will succeed in transforming the educational landscape, and, if they do succeed, what the consequences will be for employees, employers and education institutions. It is, however, indisputable that the outcomes of these emerging practices will be of significant importance for the future of the OER movement, and for the resilience and competitiveness of the economy of Europe. To gain insight into this uncharted territory, we have interviewed 11 experts who are deeply engaged with OER and credentials, eliciting their views on this fast-evolving landscape. The objectives of the interviews were to identify and describe

- (O1) the different ways in which knowledge obtained through OERs is credentialled in OER repositories in Europe.
- (O2) the barriers to the certification of knowledge obtained through OERs
- (O3) the actions which could eliminate or mitigate the obstacles to the certification of knowledge obtained through OERs

3. Method

Given the wide range of relevant initiatives underway in institutions and industries across Europe, varying widely in their focus, it was not considered feasible to identify a statistically representative sample of experts and representatives of OER repositories. Rather we gathered suggestions for interviewees from the network of the Encore+ project, as a community which includes leading individuals and institutions active in OER in Europe. This strategy was enhanced by the co-location of an Encore+ project meeting at the OEGlobal 2022 conference in Nantes, which provided the location for the first interviews, and a source of further suggestions for interviewees. Fourteen people were invited to interviews, with eleven interviews being carried out. A decision was made to avoid interviewing members of organisations which are funded members of the Encore+ consortium.

The interviews were semi structured. They were guided by the questions shown in Appendix 1, but the interviewees were encouraged to discuss any aspect of the topic which they considered relevant. The interviewees and their affiliations and expertise are shown in appendix 2. The interview procedure was reviewed by the UNIR Research Ethics Committee (approval PI049/2022). The interviews were all conducted by the UNIR research team, and lasted between 45 and 65 minutes. Two interviews were face-to-face, and the rest were conducted by Zoom or Teams. Five of the interviews were transcribed professionally, and the remaining seven were transcribed by the project team. Following transcription, the interview texts were lightly edited to remove hesitations and repetitions, and any obvious transcription errors. The texts were then sent to the interviewee, with the invitation to check for errors, and to make any corrections or changes that they would like. The corrected texts, approved by the interviewees, were then used in the analysis. The corpus came to a total of 4,541 lines of text, and 328,177 characters including spaces. Following analysis, the transcripts were stored for consultation on request by other researchers.

The open-source QualCoder application (https://qualicoder.com/) was used to classify the many points made by participants, and to organise the text fragments into collections which discuss particular topics. As our starting point for the analysis we took the three contributing discourses of alternative credentials, interporable descriptions, and recruitment, and this proved to be an effective high level classification of the points made in the interviews. We then considered the cross-cutting themes of business models and sustainability.

Cited text from the interviews is indicated as follows:

Short sections are reproduced within the paragraph in italics

> Longer sections are indented in a separate paragraph in a smaller font size

The numbers given in parenthesis correspond to the lines of text in the transcripts.

> **At the end of each section a box like this summarises the key points**

4. Findings

4.1 The role of OER in traditional and alternative credentials

4.1.1 The central importance of assessment

Consideration of "Credentialing learning in the European OER Ecosystem" raises the question of exactly how interactions with an OER can lead to a credential. Most of the interviewees discussed this primarily in terms of MOOCs, particularly those working in universities, whereas those in industry, in sectoral organisations, and consultants spoke mainly of micro-credentials and badges.

Arnold stressed the central importance of assessment in the discussion of credentialing and OER.

> I don't think you can apply credentialing or micro-credentialing to the OER itself. Because a micro-credential, what does it recognize? It recognizes a person's ability to do something. If you're talking about the OER as the object, you can certify the quality of it. But that's a whole different process. If we're talking about credentialing or micro-credentialing, then we have to look at the way the OER is being used (Arnold, 32-36)

Deville (125-127) emphasised that the issuing of a credential requires the agency of individuals and/or institutions: *quizzes or exam questions could also be open content, but this is not the assessment part. The assessment part is that someone organizes the assessment and chooses the assessment, and then decides if the student succeeds or fails*. Frequently OER is used in a

traditional learning setting to lead to a qualification issued on the basis of assessments which were in place before the introduction of OER. Santos argued that this is a valid and important way of linking OERs with credentials:

> you were talking about how to bring the OERs to MOOCs and other courses that need to be accredited. But I'm proposing the contrary. Do you have an accredited course or formal course, or whatever, and can you implement OERs together with the rest of the resources in a diverse platform environment so they can be in parallel with other kinds of resources and the assessment is the same? (Santos, 72-86)

However, though not suggesting that the use of OER in traditional courses is a bad strategy, de la Higuera (19-21) argued strongly that existing assessment practice has serious problems. *I really don't believe that we're doing it right, so it's not about thinking that OER should do it at least as well as the real world. The real world is making a big mess out of this.* One of the problems he identified is that of technology which is undermining traditional assessment in languages and mathematics. There is also a problem, experienced in on-line education, in verifying the identity of the learner when carrying out online assessments. Read described his work establishing MOOCs with online assessment for UNED (a Spanish distance teaching university).

> A popular question … was "how do I really know it's you that's doing the test?". It could be your cousin, the smart one. You could have just turned up for the course and he does the test and you get the benefit. … I'd answer that I completely agreed… But the point is that I believe that these sorts of certificates are good enough to get you an interview, not to get you a job. (Read 59-64)

Peer assessment is a possible alternative to traditional assessment methods, but it is not always easy to transfer from face-to-face environments to online. As Arnold described the challenges faced working with MOOCs in the Open Virtual Mobility project:

> …it's very difficult to have sufficient numbers of learners at the same stage in the learning process to do the peer assessment because everybody is entering at different stages. If you've got to do a peer assessment at the end of three weeks, maybe you've got people who are just starting. … and we needed that peer assessment component to make the micro-credential as valid as possible. It wasn't just a learner doing a few quizzes and to say "I have that competence". (Arnold, 102-107)

Consideration of "Credentialing learning in the European OER Ecosystem" raises the question of exactly how interactions with an OER can lead to a credential. Assessment plays a key role in this process, but is complex and contested in education as a whole. Who carries out the assessment, and how, are key questions. Online education brings additional challenges which are intensified by the ambition of OER to provide education at a large scale and low cost.

4.1.2 MOOCs

MOOCs were discussed by all but one of the interviewees as a way to offer credentials for learning with OERs, either using an institutional LMS or an independent MOOC platform. As Mazar (99-100) says *you go to a MOOC platform and you finish a course, you can usually request a credential at the end. Sometimes, it's free, sometimes, you have to pay for it*. Read commented, for example, that (181-182) *here in Madrid, the six or seven big players, their MOOC initiatives do successfully give certificates*. It should be noted that MOOCs do not necessarily need to be composed of OERs, although in many it is a matter of policy that they should be. For example Campbell (160-161) noted that *in Edinburgh we always make sure that the content that is created for these MOOCs is also available under open license of the MOOC platform*. While MOOCs have become well established, especially in non-credit courses and life-long learning, there were few examples of the use of MOOCs as part of institutions core provision, or as an alternative to traditional teaching.. An exception was Deville's description of the EVE project (https://vep-online.org) in which universities shared their own MOOCs for use by students in other universities for credit. De la Higuera (80-85) gave a striking example of resistance to MOOCs in core provision, having proposed their use in courses for doctoral students.

> Arguments against this idea were like "Oh they (the PHD students) are not serious. They're not going to do it", or whatever. Then you argue, well I once gave a lecture in English in the doctoral school and found out at the end that five of the people there who ticked the box "I have attended" didn't even speak English. Nothing. But it was okay for the school -- you know, they ticked the box.

Such resistance seems likely to be a factor in limiting the impact of MOOCs on mainstream education.

Mazar commented that the credentials offered by MOOCs *are kind of machine readable, but they're not tagged enough to allow the machine to find out what bit of textual content stands for what concept. You probably wouldn't be able to interpret the credential and find what is the title, what is the achievement, which bits are describing the learning outcomes, etc. (Mazar 93-98).* To the degree that this is the case, interactions between MOOCs and other components of the OER ecosystem are restricted.

> **MOOCs are a well established way of linking OERs with credentials and are well established in non-credit courses and life-long learning, but there are few examples of the use of MOOCs as part of institutions core provision, or as an alternative to traditional teaching. MOOCs do not always use OERs, they remain on the educational margins, and their certification is not always interoperable.**

4.1.3 Competences, learning outcomes, micro-credentials and badges

There was a strong consensus among the interviewees that **competence structures and/or learning outcomes are an important link between OERs and assessment**. For example, Arnold (54-57) suggested *I would be looking at whether there are learning objectives or learning outcomes, or whatever you want to call them, embedded in the OER itself, and then I would also look at how are those learning outcomes assessed.* A number of interviewees pointed out that **standardised competences or learning outcomes can make it possible for different people or organisations to produce OERs and to assess the learning achieved through them**. For example, both Edinburgh University and URC Louvain maintain separate organisational units for the production and management of OERs, and for the development of MOOCs which create learning paths with the OERs and assess the learning achieved through their use. A further potential benefit is the disaggregation of learning, as Barker commented *If there's something that you're interested in, you don't have to do a four-year degree course in order to learn that thing. You can, in theory, just pick the bits that are interesting to you.* However, there was also a widespread recognition of the challenges raised by working with competences and learning outcomes For example, Olcott emphasised that this approach is neither new, nor simple to carry out: *It is NOT easy when you have to sit down and you have to identify all those competencies and minimum skill levels and performance levels, it is a laborious and detailed process that requires very talented assessment people. Their time is valuable.(Olcott 448-452)*

Similarly, Jacqmot (140-153) noted the need for precision in learning outcomes, and inconsistency in the degree to which this is achieved in different education systems.

> … on the side of assessment and on the side of OER, we have to define very precisely the learning outcomes that are developed by the OER. We need a strong alignment between those two. …we also need to have a rubric available for each assessment, which is the grid that defines for each learning outcome what should be demonstrated by the learner or the trainer and at which level of ability. In the States, and maybe in England, learning outcomes are usually well defined, but not too often in French speaking or Latin education. Similarly, rubrics are very difficult to construct, and again we find some rubrics in the United States, but not so often in French speaking education. That's a constraint we have to address if we want to consider OER for self-learning together with formal assessment organized elsewhere: we need to have those connecting elements, the learning outcomes and rubrics.

Barker (328-337) stressed that it is both possible and important to maintain the possibility of open-ended educational experiences within a competence framework, for example through reflective portfolios and self-assessment.

Once a curriculum that leads to a qualification has been disaggregated into competences, it is an obvious step to consider if the qualification can also be disaggregated, into micro-credentials or badges. Most interviewees saw this as a natural route forward for credentialing learning in the OER ecosystem. There was, however, some concern that an

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over-production of micro-credentials might be problematic. Barker (110-113) cautioned that moving away from traditional course structures may also have costs: *universities do a great job of aggregating together lots of different things that need to be learned in order to master a subject. There's a risk of losing the expertise that's required to build learning pathways.* Similarly, de la Higuera (172-176) commented that *Micro-credentials scare me, because if it's just "Click on a few buttons and then you get a micro credential", we're going to have so much noise there.* He suggested that micro-credentials may be successfully offered byu big players like Coursera, who can pay human beings to understand the learner interactions.

A number of interviewees drew attention to the potential for micro-credentials to be re-amalgamated in a flexible way by defining learning paths. Jacqmot (361-362) said they *could be a way to organize things and help people to follow their own pathway, maybe an adaptive path through learning material to obtain new competencies.* This leads to an aspiration that *flexible learning pathways could lead to supporting personalized learning journeys of lifelong learners* (Mazar 151-152). Micro-credentials can be 'stackable', i.e. they can be combined to contribute to more substantial qualifications, which potentially *will give an advantage to OER because they are small and agile* (Mazar 366-367). Deville (335-343) described how professional organizations can reuse OER to build pathways related to the needs of the market, and gave the example of an initiative for open learning labs in IT learning centres in Belgium.

The combination of micro-credentials into learning paths and qualifications requires the development of new processes and methods. Barker described some of the current work in this area.

> … Credential Engine are working on credential transparency as a whole. One of the things that we've been working on recently is representing pathways through learning … representing the way in which a program is aggregated from individual steps and components, and what are the requirements at each stage. Concentric Sky have the Badgr platform. … They talk a lot about stackable badges, and Concentric Sky have their own way of building pathways along micro credentials. (Barker, 132-146)

Competences and learning outcomes are perceived to have many advantages in linking OERs and credentials but their use remains patchy. Authoring requires substantial time and expertise, and rubrics are needed for assessment. In addition to facilitating assessment, competence structures offer a way to structure learning paths and to create 'stackable' credentials.

4.2 Interoperable descriptions of learning achievement

4.2.1 Trust and verification

There was general agreement that it is essential that the learning achieved through OERs should be recognised in other contexts. As Read (73-74) says, *any kind of certificate is only*

worth the value of the institution or person who's actually giving that certificate. **There was also agreement that technological systems are needed which can verify the identity of the issuer.** As Mazar argued, if credentials are *verifiable, tamper-evident and machine readable then the learner can use them to prove their skills and competences more readily* (172-173). Hopefully, this means that *people do not have to live through the same learning experience twice just because there's resistance or lack of trust* (Mazar, 249-250)

Many interviewees felt that the existing standards and specifications provided a solid basis for moving forward. For example, Mazar mentioned the European Classification of Skills Competencies; Qualifications and Occupations (ESCO); JRC's European Digital Competence Framework; the national and the European Qualifications Frameworks: UNESCO frameworks such as the ISCED fields of education: and the European Credit Transfer and Accumulation System (ECTS). She argued that argued that such existing standards and frameworks can be used

> to make OERs and the outcome credentials machine readable and tagged with the relevant tags of knowledge, skill and competence labels. To identify the broader subject relevance (e.g. ISCED) is also important, so that anybody, including the learner, who's seeking training or learning, as well as the verifier or the viewer of credentials, can see what this person knows as a result of learning through this open educational resource. (Mazar, 349-355)

Similarly, Read (118-125) praised the work of the European Commission's Europass, for its definition of 'micro-credential', and for its *underlying technical architecture which meant you could use eSeals to issue certificates and so on. I think that really represented a before and after in the question of the certification of open education, micro credentials, digital micro-credentials etc.*

Arnold emphasised the important role of the European Commission in building trust.

> …I think what builds trust is examples of where things have worked... the ECCOE project is based on the European Commission solution for European Digital Credentials for Learning, and so the whole argument of our trust there is based on it coming from the European Commission, so it is trustworthy. But all these different trust mechanisms have built in authentication checks, validation checks, transparency "This credential has been issued by so and so, for this reason, it has been stamped here and it is valid and it hasn't been tampered with". … It's not the European Commission delivering it. John Smith is delivering your credential to Jane Doe. But when everything is transparent, you know what it is. (Arnold 300-309)

Mazar provided more details of the European Digital Credentials for Learning

> … the portal I helped to develop, the European Digital Credentials for Learning, doesn't let you issue a credential unless you sign it with a qualified or advanced electronic seal. Then if anybody changes a single digit in the code, the electronic seal breaks, the tampering becomes evident to the credential viewer. So the institution who issues the credential has to formally seal it. Once that's done, they're liable for the credential and can go to court if, for example, they were not accredited... (Mazar, 277-283)

In combination with ECTS, this provides an admissions officer for continuous education with *a currency that I understand and I can interpret* (Mazar, 287-288). Olcott identified the importance of ECTS or similar systems building collections of micro-credentials: *there's going to be an equivalency conversion process. In other words, if you want to stack these micro-credentials onto, let's say, a credit certificate, then you're going to have to convert it within some context so that it fits within that qualifications framework.* (Olcott, 73-74). Olcott cited the European MOOC Consortium as a good example of seeking the best way to recognise quality and rigor, based on European credit standards, while noting that the issue of how many credits should be assigned for a particular piece of learning remains unclear. He emphasised the importance of providing a transcript that documents *specific competencies and levels that somebody must perform to demonstrate a particular skill level and then subsequently to be certified.* (Olcott 104-110)

Barker (77-78) drew attention to the work of the W3C Credentials Community Group, which has since 2014 been exploring the creation, storage, presentation, verification, and user control of credentials, https://www.w3.org/community/credentials/ and the W3C Verifiable Credentials Working Group, which is currently working on the Verifiable Credentials Data Model (VCDM) 2.0 (https://www.w3.org/2022/06/verifiable-credentials-wg-charter.html). Barker also described the challenge to be faced in achieving interoperability of descriptions of credentials across multiple domains and countries, *how you map what's represented in Standard A into what's represented in Standard B.* (Barker, 272-273)

Olcott (129-132) sounded a note of caution about standardisation. Without suggesting that standards and interoperability specifications were unnecessary in general, he identified a danger of constraining the necessary variety of credentials: *Europe is trying to go down the road with micro-credentials of coming up with one great big flavour that works for everyone. I think they're making a mistake. I think you'll have to make it so broad that it just won't be flexible enough to deal with the diversity that exists within each of the countries.* Similarly Deville (354-356) suggested that it is too early to propose a specification for the stacking of micro-credentials in learning paths. *If we develop a protocol for this, that could kill many initiatives. I would like to let these pathways be organized, and I think evolution will drive the organisation of pathways using nice protocols.*

We have included the issue of **trust** under 'interoperable descriptions', because this is the approach which most interviewees discussed. However, de la Higuera commented that in Open Education Global 2021 English language sessions discussed trust in terms of a market based on 'likes'; while Spanish language sessions stressed trust in the teacher, and French language sessions referred to ministerial approval. Whether or not this observation is replicable, it reminds us that the mechanisms which lead to trust are in part culturally determined, and vary across countries and contexts. Rather counter to de la Higuera's anecdote, Santos (216-219) speaking from a Spanish perspective said that in order to achieve trust, *The national agencies should ensure that this is useful for accreditation, for teachers and researchers in this example. Of course, we have to engage other institutions like national quality agencies that are doing this assessment, otherwise, it's not going to work.*

> **Trust in credentials based on learning from OERs is generated by the verifiability of assessment and the issuing institution. It is generally accepted that interoperable specifications and competence frameworks are the best way to achieve this. The infrastructure to achieve this is largely in place, with a strong contribution from the European commission and W3C, and technology is not a barrier. The use of specifications and competence frameworks needs to be intensified. Achieving practical interoperability of descriptions of credentials across multiple domains and countries is a challenge.**

4.2.2 Technology to the rescue?

The interoperability issues identified in the previous section are technical, but are concerned with making the existing technology work more effectively. **None of the interviewees mentioned any emerging technologies that might transform practice in the credentialing of learning in the OER ecosystem**. Some interviewees were explicit in rejecting technological fixes for the questions under discussion. Barker, whose work has a strong technical focus, said

> I honestly don't see technology as being a barrier at the moment. We've said this so many times before. The technologies are there. What's required is the … capacity to use the technologies. That doesn't mean the technologies don't still need developing but they will be developed as soon as there is the capacity to use them. (Barker 253-257)

Similarly, Olcott (221-222) said *I'm reminded recently of an article I read where the authors argued quite persuasively that digital transformation is not about technology, it's about business models. And they were right.* De la Higuera (473-474) commented that *People are looking for technical solutions. It's not about technical solutions, not for the moment.* As a full professor with a specialism in AI, he was skeptical about the hopes for AI to provide automated assessment of learning obtained through OERs, and emphasised its tendency to embed existing poor practice: *If anything, AI proves that we're evaluating syntax and shallow semantics.* (de la Higuera, 383-384).

> **Emerging technologies do not offer solutions to the challenges faced in integrating credentials into the OER ecosystem.**

4.3 Credentials and recruitment

Olcott stressed the importance of the transcript in mediating the relationship between learners and possible employers: *For learners, it is clearly important that their credentials, and the skills and knowledge which they document, are recognised by employers*. This view was widely accepted among the interviewees, as was the need to provide a detailed record of the achievements of learners. There was, however, a wide range of views on the degree to which competence-based formal descriptions of learning obtained from OERs could or should

streamline the recruitment process, or even automate it. To take two contrasting positions, on the one hand, Mazar argued that

> Now that people apply for jobs electronically, there are so many applications for any job that HR management systems will have to use some kind of algorithm to scan CVs and credentials for the candidate's suitability for the vacancy. If the data is structured enough and available in a digital machine-readable format, that would probably support the credential holder to prove their fitness for the vacancy. This sounds very futuristic. But I'm quite convinced that, sooner or later, this could be quite important and would benefit citizens who have digital credentials. Consequently, this would provide an incentive to education and training providers to supply these kind of data rich and structured credentials. (Mazar, 239-247)

At the other end of the range of opinions, de la Higuera was very doubtful that such automated systems would provide good results.

> … I can't see how I am going to be convinced by somebody who's going to arrive and say, "Well, you know, I've had this, this and this and this certified by all these blobs". I will give that person a chance. I would say, "You've done a lot. Come into my office, let's talk about it.", and I would try to pinpoint some of those pieces of knowledge that you should have gathered through that. (183-187)

These two approaches to the use of credentials are strongly contrasting, but existing specifications and frameworks are sufficiently flexible to support both of them. **The detailed machine-readable data required for a candidate to demonstrate fitness for a position can also be used to provide a rich representation of a candidate's claimed skills, to be probed in an interview. Similarly, the infrastructure for claiming competences can be used by individuals or groups of professional peers, as well as by established institutions**. As Barker pointed out: *badges and micro-credentials and the W3C verifiable credentials … can be self-asserted. You can issue yourself with a badge that says, "I say that I know how to speak Spanish and you can test me on that if you want.", it's an assertion that you're making.* (Barker, 77-80). Barker stressed the relevance of current work in the U.S. led by the Chamber of Commerce Foundation on the "Learning to Earning" employment ecosystem, which is *pushing a lot on competence based hiring, and that's mirrored with the idea of competence-based education.* (Barker, 292-293). In the end, the success of competence-based recruitment, and the opportunities which it offers the credentialing of OER, will depend on practice rather than the specifications and frameworks which are implemented. This varies between sectors, and as Barker commented *I don't think a piece of paper alone will get you a job as a programmer anywhere. You actually have to show that you can program. For other professions, that might be less true. There is a resistance.* (Barker, 244-249)

Read stressed that we should not only be discussing recruitment, but also on-going personal development. *We really are in the context of Lifelong learning, where people are continually having to update their knowledge. ... Open education is a great way of doing that.* (Read, 187-194). The specifications and frameworks which enable competence-based hiring can also support employees in keeping up to date in their jobs and in the employment market, and demonstrating that they have done so. As Olcott (314-315) pointed out, training providers

working with employers also have a motivation to make use of competence-based systems: *Whoever is providing the training, is going to have to communicate with employers and show that their employees will be able to do A B and C if you if you purchase our training.*

> There is great interest in HR systems which scan CVs and credentials for the candidate's suitability for the vacancy, and support employees in life-long learning (particularly in the US). The degree to which this will be an effective recruitment policy is an open question. OERs + credentialing + competence descriptions are well placed to provide input into these systems. Collaboration with professional communities is a promising approach, to ensure the relevance of OER to employment.

4.4 Business processes

We have seen that there is plenty of innovative thinking about the potential for credentialing learning in the European OER ecosystem, and that the necessary technology is largely in place. However, our interviews also made it clear that the quality of automated assessments is doubted, that assessment which depends on human judgment is expensive, and that identification and verification of the credentialing organisation is essential. It is therefore necessary to consider the business models and organisational structures which could justify the expenditure required for a change in practice. In terms of the services that can be offered to learners. Deville and Jacqmot described their 'Framework to Understand, Analyse and Describe Online and Open Education in Higher Education'' (see Jaqcmot, Docq & Deville, 2020), which divides institutions' operations in open education into the provision of content, learning pathways, interactions with teachers or peers, and assessment. As Deville discussed *The added value is really what the teacher does with the learners, it's worth money* (302-303) and because of this, different economic considerations apply to the different quadrants (368-376).

> In the quadrants for the content and the learning pathways the marginal cost of opening materials and pathways is zero. So if I put an OER or a courseware on some open Moodle platform, and get 1,000,000 downloads, there is zero marginal cost for me. But if I want to have organized interactions or assessment, there is a marginal cost there. I cannot do that for free, there is no model where everything is free. This is a barrier, that once you want to organize interactions and assessment, you need a business model. Even if the price is very low, you need some business model because as a university, we cannot just give certificates to the whole world. How should we organize these credits and these interactions in a sustainable model?

These quadrants offer a way of analysing organisational structure and collaborations. It may seem natural that OER production and assessment should be carried out by the same person or organisation, after all it is the provider of the OER who is in the best position to understand the learning that the OER offers. However, Deville insists that there are strong reasons for

> … a clear separation between the platform where we provide open material, and any kind of system to do the assessment and to give credits … essentially because the marginal cost is zero for the openness and it's nonzero for credits.... We want a learning pathway to be as open as

possible, but as soon as we are dealing with assessment, then it cannot be fully open. It is just technically impossible. (Deville 385-391)

Similarly Campbell described how *alongside the OER service, where I work, in Edinburgh we have another service altogether called the online course production service. They are the team that build our MOOCs and free short online courses.* (Campbell, 153-155).

Various models of collaboration can be derived from the Deville and Jaqcmot's quadrants. **A university may design and organise its own courses, but make use of OERs from another institution, or it may adopt learning paths from elsewhere. These collaborations require little or no interactions between the partners. However it is also possible for a university to delegate the interactions between the learners and with the teachers, but to maintain assessment and validation of the credits. Finally, there may be complete delegation of content, learning paths, interactions and assessment, with the university only being responsible for recognising that the assessment corresponds to its standards.** Jacqmot (140-163) emphasised that unbundling of educational services in this way is not a simple matter.

> If we consider the assessment as the way to formally measure if the outcome is reached, then on both sides, on the side of assessment and on the side of OER, we have to define very precisely the learning outcomes that are developed by the OER. … I'm not sure it's obvious how to tackle the outcomes when you are conceiving and producing the OER and the assessment in different parts of the world, and if we can hope that those two will be aligned.

The business processes of credentialing learning from OERs are the provision of: (a) content, (b) learning pathways, (c) facilitating interactions with teachers or peers, (d) assessment. The marginal cost for (a) and (b) is zero, it is non-zero for (c) and (d). There is a strong argument for organisational and financial separation of zero and non-zero processes, thus separating OER storage and delivery from assessment. Additionally, merging pedagogic expertise with delivery of OER content may be organisationally sub-optimal.

4.5 Business models and sustainability

Throughout this report we have seen that **credentialing learning in the OER ecosystem involves work by highly skilled people, it is not something that can be set up and will run at minimal cost. Who will pay for this work? The process is complex, and the costs will be incurred in a range of different contexts, and so it is to be expected that a mix of revenue streams will be required.**

The production of OERs is often of low cost to the institution, produced by teachers as part of their course development and teaching preparation, or by enthusiasts whose time is not accounted for nor remunerated. As Read (556-558) said, *being an academic is a vocation... So we all have a tendency to produce content and share it with anybody we catch walking down the street.* De la Higuera (483) also believed that *OERs are sustainable per se*. In this sense, the

production of OERs is sustainable. However, Mazar warns that it is not reasonable to expect these authors to extend their efforts to assessment.

> it must be really difficult for the OER providers, when they don't even know how much their OERs are taken up by learners, to spend extra effort thinking about credentialising, thinking about making it granular enough, proof enough, digitally readable enough, standard compliant for just a handful of people per year to use it? So when you get to "What's the benefit," the number of users who may benefit from the credential is so small. (Mazar, 123-128)

We will now briefly discuss **possible sources of funding for credentialing in the OER ecosystem**.

Learners can be charged for access to MOOCs, and for assessment. Olcott (436-452) argued that when working with OERs it was reasonable for universities to charge for the design of courses, creation of learning paths for training, and non-credit courses, and still more so for assessment. The cost of micro-credentials remains unclear, *in very technical areas they won't be cheap. … it is a laborious and detailed process that requires very talented assessment people.* (Olcott 441-451). Arnold (392-394) agreed that charging for assessment was to be expected, saying that *for some things you actually pay, like 500 pounds to get the credential, because there's a formal exam involved, or something with ID verification of the person.* Read agreed that charging learners was an acceptable strategy, but cautioned that care should be taken in charging for access to MOOC content.

> …rather than trying to charge you £50 for my next three units…. I wouldn't think twice about inviting you to a cup of coffee for a chat, so why should I think twice about paying you that money for reading 30 pages of cool content you've written? I think if you get the long tail effect of people paying small amounts of money, then you can make it scalable. (Read 577-584)

Funding can come from within institutions. The case for supporting OER within the institution is well established, and accepted by the interviewees. As Read (197-200) summarised, rather than content being the crown jewels, *the more you give away the better you are, the more prestigious, because the chances are that people actually will have to click through. They've done your free course… they go through to something else.* Olcott argued that institutional commitment to the production of OERs will be increasingly important, as funding for open educational practices from foundations and government agencies will not last forever. *I think our best bet … is that if the institution values it, they will fund it. Maybe not at the levels that we would hope they would, but it's a start. The monies are given to the academic Deans, and they can determine how they are used within their school.* (Olcott 390-395).

It is now clear that publishing content as OER can be a sound financial strategy. But publishing has always been a side concern for universities, whereas the ability to confer credentials is the core of their identity. Linking credentialing to OER therefore raises many strategic questions for institutions about their identity and income. One answer for institutions is that credentialing learning obtained through OERs is an effective way of generating a funding stream from

non-credit training, while leaving their core provision untouched. However, Deville proposed a reason why it may be a good idea to link OERs and credentials even in core teaching.

> If you want to sell something, you have to show the client that what you are selling really has value. If you don't show anything they just have to believe that it will be good. So, you can show the content "Look here it is, isn't it nice", but students are comparing everything on the web all the time. They will see materials on physics, or whatever, everywhere. Are we asking them to believe that the university of wherever … has better materials? The added value is really what the teacher does with the learners, it's worth money. (Deville 297-303)

This suggests that for a university it is worth subsidising OER based courses that include student interactions and assessment, because it provides a stream of future students.

In addition to these purely financial considerations, many universities have a sense of a mission to spread knowledge and improve society, and indeed this is a logical corollary of publicly funding in countries where students do not bear the full cost of their education. Campbell emphasised the role that this plays in the activities of the University of Edinburgh.

> …the University's current mission and vision statement is about sharing knowledge to make the world a better place. … People do genuinely believe that, it's not just words…. So open education resources, books, Wikipedia assignments, open data. It's all just the latest manifestation of that mission. (Campbell, 455-472)

The state or the European Commission can provide funding. In contrast with Olcott's view, above, that funding from government agencies will dry up, Read made a strong argument that the state has a duty to support credentialing within the OER ecosystem:

> … we really need to expect our governments to actually support and fund it. Perhaps indirectly I'd also criticize the European Commission in the same way. … If they want to have open education, open certification, etc., then they have to give us funds to make it possible. …A lot of education institutions are having difficulty reaching the end of the month. ... who's actually paying for this sort of thing? And is this what society really wants? (Read 165-179)

The interviews gave a great deal of credit to the European Commission for its work in creating the necessary frameworks and infrastructure for credentialing in the European OER ecosystem, but it is not clear that funding will be available for developing practice. As regards national funding, Read gave the example of Portugal, where the government is

> … trying to use digital micro credentials and open education as a transverse mechanism for certifying everything. We're talking about firemen, policemen, everybody. When you want to go for some kind of professional training, from what I hear from my colleagues, you're going to be given digitally certified educational objects. As far as possible people are very keen to do this in terms of open education. (Read, 132-137).

Funding can come from companies. Read (413-416) saw a possibility that corporations might be willing to support institutions with the costs of credentialing. Deville thought it more likely that companies would enter the market by offering credentials for learning with OERs. He envisaged

a threat to higher education institutions from '*Google universities*' that *just provide materials and credits*. In response, education institutions need to *demonstrate the added value of teachers' interactions with students.* (Deville 302-311)

4.5.1 OER repository infrastructure

An important business decision concerns who should run the necessary infrastructure. Both Barker and Campbell argued that OERs repositories have become outdated. Campbell described that while Edinburgh University maintains a large media server, OERs are stored in a distributed way on the Web. She argued that this strategy was resilient (in that it does not depend on continued funding for a repository), and also ensures that resources are put *where they can most usefully be found and used by other people* (Campbell, 213), for example hosting OERs for Scottish teachers on TES (https://www.tes.com/teaching-resources).

Deville took the opposite position, arguing that

…it's important to have repositories that are close to the producers. We were able to convince people to contribute because it was a University repository. … on the other hand, it's very important to be seen by the whole world, which means that our repository must be also integrated within larger repositories through harvesting. (Deville, 401-405)

Olcott (178-17) argued that running their own repository enables institutions to maintain the functions of good management and leadership needed to run micro-credentials.

Revenue streams for credentialing learning from OER can come from:
- **Learners' payment to access learning paths (low cost) and assessment (from low to high cost)**
- **Education institutions and foundations, as a loss leader or to fulfill an educational mission**
- **The state or the European Commission**
- **Professional bodies or companies**

All are viable, but depend on global and local economic and political developments. Providers should consider if it is beneficial to outsource and/or distribute OER and MOOC hosting.

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5. Concluding remarks

The interviews that we have carried out confirm that it is sensible to view the role of credentialing in the European OER system as being a function of the intersection of innovation in alternative credentials, the adoption of interoperable credentials and the development of competence-based human resources management and recruitment. In each of these areas of discourse we have seen differing opinions and multiple strands of practice, making it hard to summarise current trends, or a likely destination. Nevertheless, some findings can be put forward.

Firstly, it was assumed in the description of work for this report that the locus of investigation would be repositories, but **we have found no examples of credentialing being implemented in repositories**, and indeed some interviewees argued that OER repositories themselves are no longer useful. Moreover we have seen that OERs and credentials are strongly contrasting in many respects.

- OERs are published to the world; credentials are issued to an individual.
- OERs can be reused anonymously many times in different places; credentials depend on a single act of assessment by a named person or institution.
- OERs gain credibility by use or authorship; credentials depend on validation by an institution.
- The publishing of OERs has a marginal cost of zero; the marginal cost of assessment for credentials is non-zero.

It is therefore hard to imagine how OERs can be credentialised by packaging the OER with an assessment on a repository (leaving on one side the question of whether an assessment that can be packaged in this way would be sufficient for any but the least prestigious credentials).

Secondly, the challenge for the credentialing of learning from OERs lies in identifying an academically effective, affordable and sustainable assessment method. We have discussed a range of options including traditional courses, MOOCs, micro-credentials and badges and their affordances, advantages and disadvantages. It is up to education institutions, professional organisations, employers and governments to consider their own context and aims in choosing which is the best for them. Moreover, given the differences between OERs and credentials in the bullet points above, **there is a strong argument for conducting the design and delivery of assessment in different departments or institutions from that of OERs**.

Thirdly, we have found a strong consensus that the necessary infrastructure of competence frameworks, digital certificates and interoperability specifications is now available to support the issuing of micro-credentials, their stacking into more substantial qualifications or curriculum vitae profiles, and communication of achievement to employers. However **practice remains patchy across Europe**. Whatever the potential may be, we have heard no evidence of significant realignment of education and training provision in Europe as the result of the introduction of MOOCs, nor of the more recent micro-credentials and badges.

Fourthly, assessment is expensive to design, and if it is of high quality it is often expensive to administer. **A key challenge is to find a business model which pays for assessment of learning achieved with OERs.** Learners will no doubt contribute, as they do at present with MOOCs, but if the combination of OER and micro-credentials is to lead to a large scale upskilling of the European workforce, there is a strong argument that the countries of Europe, and the European Commission, will need to fund not only the development of frameworks and platforms, but also the creation and delivery of qualifications. Such initiatives will not be simple to establish, as they involve navigating between the interests of many institutions and groups. More generally,

our discussions indicate that the practice of credentialing in the European OER ecosystem will be determined by the wider social, political and economic processes in society, with the implication developing that practice will involve engaging in those processes. As Read (165) said *it's a question for society to decide: what are our key values?*

Reference list

American Workforce Policy Advisory Board Digital Infrastructure Working Group. (2020). *Learning and Employment Records Progress and the path forward*.
https://www.commerce.gov//sites/default/files/2020-09/LERwhitepaper09222020.pdf

Bennett, V., & Lamback, S. (2020). *Transforming IT Training Programs*. JFF.
https://jfforg-prod-new.s3.amazonaws.com/media/documents/Transforming_IT_OnRamps_-_July_2020.pdf

Boiko, J., Volianska-Savchuk, L., Bazaliyska, N., & Zelena, M. (2021). *Smart Recruiting as a Modern Tool for HR Hiring in the Context of Business Informatization*. 2021 11th International Conference on Advanced Computer Information Technologies (ACIT), 284–289. https://doi.org/10.1109/ACIT52158.2021.9548558

Britannica. (2022). *What is a university?* https://www.britannica.com/question/What-is-a-university

Brown, M., Nic Giolla Mhichíl, M., Mac Lochlainn, C., Pirrkalainen, Henri., & Wessels, O. (2021). *Paving the Road for the Micro-Credentials Movement—ECIU University White Paper on Micro-Credentials*.
https://www.eciu.org/news/paving-the-road-for-the-micro-credentials-movement

Cappelli, Peter. *Why Good People Can't Get Jobs*. Philadelphia: Wharton, 2012.

Cornelius, Dave. 'The Education and Skills Gap: A Global Crisis'. *Techniques*, 2011.
https://files.eric.ed.gov/fulltext/EJ926104.pdf.

Europass. *The European Qualifications Framework (EQF)*, 2022.
https://europa.eu/europass/en/european-qualifications-framework-eqf.

European Commission. (2022). *ESCO*. https://esco.ec.europa.eu/en

European Commission. (2021). *Proposal for a COUNCIL RECOMMENDATION on a European approach to micro-credentials for lifelong learning and employability*.
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0770

European Commission. (2016). *A NEW SKILLS AGENDA FOR EUROPE Working Together to Strengthen Human Capital, Employability and Competitiveness*.
https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52016DC0381.

European Commission (2015). *ECTS users' guide 2015.* Publications Office.
https://data.europa.eu/doi/10.2766/87192

European Ministers of Education (1999). *The Bologna Declaration*.
http://www.ehea.info/media.ehea.info/file/Ministerial_conferences/02/8/1999_Bologna_Declaration_English_553028.pdf.

Everhart, D., Green, T., O'Brien, J., & Soares, L. (2021). Credential Transparency Illuminates Pathways to a Better Future. *Change: The Magazine of Higher Learning*, *53*(4).
https://er.educause.edu/articles/2022/1/credential-transparency-illuminates-pathways-to-a-better-future

Jacqmot, C., Docq, F., & Deville, Y. (2020). *A framework to understand, analyse and describe online and open education in higher education.* CSEDU 2020 - Proceedings of the 12th International Conference on Computer Supported Education, 1(Csedu), 458–465. https://doi.org/10.5220/0009470704580465

Kitchens, J., Sutton, S. A., & Barker, P. (2022). *Credential Engine Schemas Handbook*. https://credreg.net/ctdl/handbook

Lado, A. A., & Wilson, M. C. (1994). Human Resource Systems and Sustained Competitive Advantage: A Competency-Based Perspective. *The Academy of Management Review*, *19*(4), 699–727. https://doi.org/10.2307/258742

Mackintosh, W., McGreal, R., & Taylor, J. C. (2011). *Open Education Resources (OER) for assessment and credit for students project* (pp. 1–19). http://hdl.handle.net/2149/3039

McGreal, R., & Olcott Jr, D. (2021). *Micro-Credentials Landscape Report: Transforming workforce futures: Strategic perspectives and practices for university micro-credentials.* Athabasca University.

MicroHE. 'MicroHE 0.1', 2018. https://github.com/MicroCredentials/MicroHE.

Rejas-Muslera, R. J., García-Tejedor, A. J., & Rodriguez, O. P. (2005). Open Educational Resources in E-Learning. *EDUCAUSE Quarterly*, *3*. https://doi.org/10.4018/ijossp.2010100101

Siemens, G. (2013). Massive Open Online Courses: Innovation in Education? *Open Educational Resources: Innovation, Research and Practice*, 1833, 5–16.

Surman, M. (2011). *Mozilla Launches Open Badges Project.* The Mozilla Blog. https://blog.mozilla.org/en/mozilla/openbadges/

US Chamber of Commerce Foundation. (2021). *Developing and Using Public-Private Data Standards for Employment and Earnings Records*. https://www.uschamberfoundation.org/sites/default/files/media-uploads/T3%20Report_Employment%20and%20Earnings%20Records_Feb2021_FINAL%20%281%29.pdf

Appendices

Appendix 1. Interview questions

- What is your involvement with OER repositories, now and in the past?

- What credentialing approaches and methodologies for OER are you aware of? Relevant aspects include administrative processes, community actions, technological support, and mappings with curricula and competence structures.

- What repositories do you know of which have considered implementing these approaches or methodologies (including your own work), and what were the results?
- Which approaches or methodologies to credentialing learning through OER are, or could be, the most effective in providing a service to work based learning and training as part of professional development?
- What are the barriers to credentialing learning through OER that you have experienced or observed?
- What practical solutions and mitigations to barriers to success have you identified and observed?
- How can trust in the credentialing learning through OER best be developed?
- What are the most important actions that could be taken to enhance the effectiveness of credentialing learning though OER? Please think of some or all of the following:
    - Learners
    - Teachers
    - Education and training providers
    - Educational authorities and administrators
    - Funders of research and innovation
- Can credentialing through OER contribute to the sustainability of OER, and, if so, how?

Appendix 2. Interviewees

Name	Organisation	Country	Experience
Colin de la Higuera (M)	University of Nantes (HE)	France	Pedagogy of IT Assessment Competence based education.
Deborah Arnold (F)	Aunege (HE alliance)	France	Life-long learning, micro-credentials and standard descriptions of credentials
Don Olcott Jr. (M)	HJ Global Associates (Educational consultants) University of South Africa (HE)	Romania / South Africa	Academic leadership Alternative credentials OER business models
Gema Santos (F)	University of Barcelona (HE)	Spain	OER repositories and reuse of resources Quality, pedagogy and community aspects
Ildiko Mazar (F)	NTT Data (IT systems provider)	Spain	Life long learning Standard descriptions of credentials, Micro-credentials
Lorna Campbell (F)	University of Edinburgh (HE)	UK	Production and management of OERs. Role of OER in HE
Phil Barker (M)	Cetis LLP (educational technology consultancy)	UK	Development of interoperability specifications for learning technology Standard descriptions of credentials Competence-based recruitment
Timothy Read (M)	UNED (HE distance education)	Spain	The role of OER in distance education OER business models,
Yves Deville (M) and Christine Jacqmot (F)	Catholic University of Louvain (HE)	Belgium	Institutional implications of OER OER business models Competences and learning objectives

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